CONTINUATION IN PART PATENT APPLICATION

TITLE OF INVENTION

Blank Panel for Rack Units

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REFERENCE TO RELATED APPLICATION

The present Application is a Continuation in Part to the equally titled US Patent Application filed 04/19/2001, Application Number 09/839,567, which is hereby incorporated by reference.

FIELD OF THE INVENTION

This invention relates generally to panels for use with rack units. More particularly, this invention relates to blank panels comprised of face plates and means for attachment to open and enclosed electronic rack units.

BACKGROUND ART

Known blank panels for use with electronic rack units are typically composed of face plates having a rectangular cross section with elongated holes positioned in proximity to the outer edges for receiving fasteners to facilitate attachment to rack units. The face plates and associated holes are dimensionally sized and configured to standards set by the Electronic Industries Association (EIA). In EIA Standard RS-310-C the dimensional standards for racks, panels, and associated equipment are specified. Three cabinet and rack widths to accommodate each of three standard panel widths, 19", 24", and 30" are covered by this Standard. 19" is the preferred width. Panel height is defined by the Standard in multiples of Rack Units (RU's). One Rack Unit is defined as 1.75".

Blank panels are typically employed on rack units for either aesthetic or enclosure purposes. A blank panel is often used to keep contaminants (such as dust) out of a rack unit and away from sensitive equipment. Rack units also often employ forced or drawn air ventilation systems to cool components. These systems require a substantially closed system to maintain proper convection flows. Open panels on the front of rack units compromise the effectiveness of these systems. Blank panels are often used to cover vacancies in the front of such rack units.

Blank panels are used extensively in conjunction with various types of rack units. Specific terminology extends to blank plates, blank panels, and face plates among others. Blank panels, as used in the electronics industry, are generally comprised of metal, typically steel or aluminum.

For examples of prior art panels and their methods of attachment to rack units see Peroni in U.S. Pat. No 5,971,507 and Odell in U.S. Pat. No. 5,312,005. The devices disclosed do not illustrate a novel means for attaching panels to a rack unit. The references employ standard elongated orifices positioned near the ends of the panel to accept threaded fasteners. In U.S. Pat. No. 5,992,808 Morrow teaches the use of a "key" for attaching electronic components and panels to rack units. The key has a geometry so as to be insertable through openings on the periphery of a panel, and subsequently through corresponding openings in a rack unit. On rotating the key through 90 degrees the key locks in position, thus securing the panel in place. This method for attaching panels to rack units offers the advantage of not requiring special tools, however, it also requires that the rack unit be modified to lock the keys in the rotated position. A further shortcoming is inherent in the shear number of individual keys required to attach a single panel to a rack unit, such loose parts are both cumbersome and at risk for loss.

References in the prior art do not discuss a means for directly incorporating fasteners with blank panels. The references also generally require special tools to operate the fasteners which they employ. Further, the prior art does not overcome the limitation of an individual blank panel not being adaptable to accommodate various height requirements.

What is needed is a blank panel that is attachable to racking units in a secure manner, which employs fasteners that do not require the use of special tools or equipment. The fasteners should be easy to replace and accommodate various rack configurations. The blank panel needs to be functional, light weight, modular and versatile. The blank panel should conform to recognized standards for racks, panels, and associated

equipment. It would also be useful if the blank panel could be modified to accommodate varied height requirements.

OBJECTS AND ADVANTAGES

Accordingly, it is a primary object of the present invention to provide a blank panel that can be securely attached to electronic component rack units.

It is a further object of the invention to provide a blank panel for rack units that is attachable without the use of special tools.

It is a further object of the invention to provide a blank panel for electronic component rack units comprising at least one face plate with means for slidably receiving fasteners.

It is a further object of the invention to provide a blank panel for electronic component rack units, wherein the blank panel comprises a plurality of face plates capable of covering multiple adjacent openings.

It is a further object of the invention to provide a blank panel for electronic component rack units incorporating a plurality of face plates, wherein individual face plates of the blank panel are modular and can be separated to configure the blank panel to varied height requirements.

SUMMARY

The objects and advantages of the invention are accomplished by a blank panel that is configured to be attachable to a rack unit. The blank panel generally comprises at least one face plate having a substantially rectangular front plate surface, a back plate surface, top plate surface, bottom plate surface and two side plate surfaces. The face plate has a height preferably corresponding but not limited to multiples of 1.75 inches. The face plate is capable of slidably receiving fasteners for being further attached to an electronic component rack unit.

Fasteners are incorporated to mate with the face plate of the blank panel and be attachable to electronic component rack units. The fasteners are configured to securely attach to electronic component rack units with alternate configurations substantially without use of assembly tools.

In a preferred embodiment of the invention, the blank panel is comprised of a plurality of face plates held together along their length with break-off grooves that provide for a manual separation of individual face plates and at the same time warrant sufficient structural strength for the blank panel.

The components of the blank panel are preferably monolithically fabricated of a polymer for light weight and durability. Optional glass fiber or the like may be added to the polymer to increase the blank panel's stiffness and/or to modulate a break-off characteristic of the break-off grooves.

BRIEF DESCRIPTION OF THE FIGURES

Fig. 1 shows a perspective front view on a plank panel of combined face plates and fasteners.

Fig. 2A is a perspective back view of the plank panel and fasteners of **Fig. 1**.

Fig. 2B is an enlarged detail view indicated in **Fig. 2A** by numeral **121**.

Fig. 3 is an enlarged perspective view of the fastener of **Figs. 1, 2A**.

Fig. 4 is a side view of a single face plate and the fasteners of **Fig. 1**.

Fig. 5A shows two face plates in a first bent position during face plate separation.

Fig. 5B is an enlarged detail view indicated in **Fig. 5A** by numeral **121**.

Fig. 6A shows the two face plates of **Fig. 5A** in a second bent position during face plate separation.

Fig. 6B is an enlarged detail view indicated in **Fig. 6A** by numeral **121**.

Fig. 7 shows the two face plates of **Fig. 5A** immediately after face plate separation.

DETAILED DESCRIPTION

Referring to **Figs. 1** and **2**, a blank panel **1** includes preferably three face plates **10** separable combined along break-off grooves **121** extending between two opposing side surfaces **16**. The face plates **10** have contact faces **13** on opposing ends and adjacent the side surfaces **16**. The contact faces **13** are separated by reinforcement ribs **55**. The contact

faces **13** are substantially planar along a first width **131**. The reinforcement ribs **55** extend along the second width **551**.

From preferably each of the side surfaces **16** extend inward along the contact faces **13** two finite channels **25** featuring overhead extensions **30**. The channels **25** are defined in combination with the overhead extensions **30** to exchangably and slidably hold correspondingly shaped mating structures **61**.

The contact faces **13** may additionally feature positioning indicators **52** for indicating a predetermined position for the fasteners **60** with their mating structures **61**. As an advantageous result, fasteners **60** may be brought into appropriate position along channels **25** prior to attachment of the face plates **10** and/or blank panel **1**.

Referring to **Fig. 2B**, the break-off groove **121** includes a thin film bridge **125** structurally exclusive connecting two adjacent face plates **10**. Positioned in a groove angle **GA** and oppositely of the thin film bridge **125** are levering faces **126** for inducing a tension force onto the thin film bridge **125** at and in excess of a break-off bending angle **B2** (see **Fig. 6B**) imposed on two adjacent face plates **10** preferably during manual face plate separation.

The mating structure **61** is part of the fastener **60** further illustrated in **Figs. 3** and **4**. The fastener **60** has at least two laterally resilient protrusions **65** extending substantially symmetrically with respect to an attachment axis **69**. The attachment axis **69** is substantially perpendicular with respect to a contact face **13** while the mating structure **61** is held in a corresponding channel **25**.

The protrusions **65** preferably feature straddle lags **651** that extend away from the mating structure **61** in an straddle angle **652** such that the resilient protrusions **65** induce a pulling force via the straddle legs **651**, the column **62** and the mating structure **61** on the associated face plate **10**, while the resilient protrusions **65** are inserted in an orifice hole **4** of the mounting bar **3**. As a favorable result, the blank panel **1** and/or face plate **10** is forced with the associated contact face **13** against the mounting bar **3**, while the fastener additionally holds the blank panel **1** and/or face plate **10** in position. In **Fig. 4**, mounting bar **3** and orifice hole **4** are indicated in dotted lines.

Front surfaces **12** of the face plates **10** may be fabricated with a slight curvature in direction across the main protrusion direction of the blank panel **1**, which provides for a smooth thickness reduction of the main plate bodies towards the intersections. In that manner, the main plate bodies may be fabricated with sufficient strength along the main protrusion direction to sufficiently oppose torsion deformation resulting during the preferably manual face plate separation. At the same time, the height of the intersections **121** may be kept to a minimum, providing a maximum leverage effect and consequently maximum tension load from a given torque preferably manually induced at some point along the protrusion direction of the blank panel **1**.

The lateral resilient protrusions **65** may further include parallel legs **652** and converging legs **653** terminating in a single closed tip. In that way, the protrusions **65** may provide a certain self centering action when approached to the predetermined orifice hole **4**. The parallel legs **652** may assist in adjusting the protrusions **65** deformation behavior and reduce peak stresses by providing sufficient deformation

length of the protrusions **65** as may be well appreciated by anyone skilled in the art. Preferably two but also three or more lateral resilient protrusions **65** may be concentrically arrayed around the attachment axis **69**.

The intersection **121** is configured to provide sufficient stiffness to the blank panel **1** and at the same time warrant limited opposition to a manual face plate **10** separation, which may be performed in a two step process. During a first bent indicated in **Fig. 5A**, two adjacent face plates **10** are bent in an angle **B1** with the front faces **12** towards each other. During the initial first bend, the thin film bridge **125** is excessively deformed after overcoming its natural stiffness. During a consecutive second bend indicated in **Fig. 6A**, the two involved face plates **10** are bent in an angle **B2** in opposite direction with the reinforcement ribs **55** towards each other. At the moment when the second bend angle **B2** approximately exceeds the groove angle **GA**, the levering faces **126** contact and become forced against each other as the second bend angle **B2** is further increased. This results in a tensile load on the previously weakened thin film bridge **125**, which eventually spontaneously rips, completely separating the two adjacent face plates **10** as illustrated in **Fig. 7**.

The blank panel **1** is preferably monolithically fabricated by injection molding. A preferred polymer material is a well known ABS with optional contents of glass or other stiffening fibers. The fiber contents may be adjusted in conjunction with the dimensions of thin film bridge **125** and groove angle **GA** to warrant instantaneous and complete separation as may be well appreciated by anyone skilled in the art.

Accordingly, the scope of the invention should be determined by the following claims and their legal equivalents.